**Nonlinear Excitation of Damped Eigenmodes in Microturbulence Simulations**

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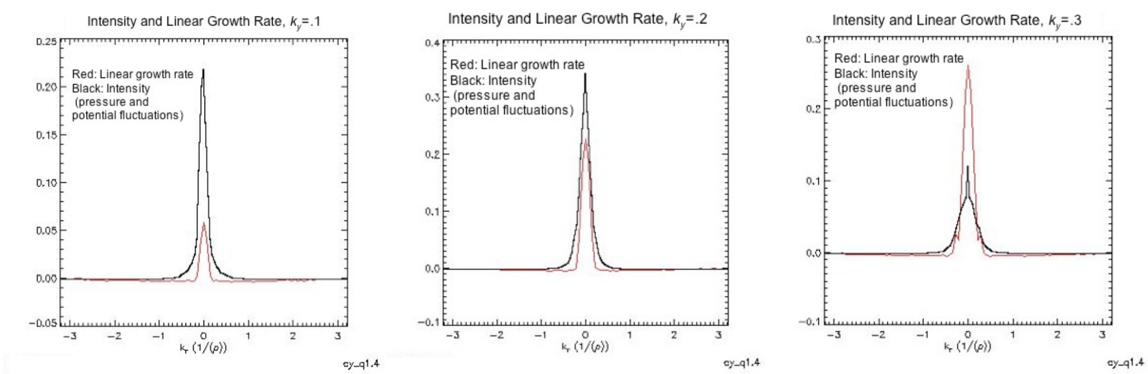
It has been demonstrated that linearly damped eigenmodes can be nonlinearly excited to levels that significantly affect both how turbulence saturates and the levels of saturated turbulent transport for both reduced CTEM and ITG-like fluid models [1]. We analyze microturbulence data from GYRO and GS2 to discover which of these effects exist in comprehensive simulations and to better understand how saturation is achieved. Comparisons of linear growth rate spectra and the intensity spectra of saturated ITG turbulence show that there is little fluctuation amplitude beyond the region of the ITG instability, indicating that dissipation at high radial wavenumber is unlikely to be the primary saturation mechanism.




Scans in the safety factor, $q$, show that fluctuation amplitudes increase with increased $q$. Geodesic acoustic modes are linearly damped axi-symmetric modes with finite frequency whose damping has a strong $q$ dependence. We examine the role of GAMs as a possible saturation mechanism. In addition, there are other features of simulation data that are consistent with the excitation of damped eigenmodes at *finite* bi-normal wavenumber. Quasilinear estimates of the heat flux significantly overestimate the observed nonlinear heat flux and there is a shift from the phase angle defined by the linear ITG mode of the cross-correlation between pressure and potential at wavenumbers above $k_y \sim 0.3$. Similar features are seen in reduced models where they are the result of nonlinear coupling to damped eigenmodes. We employ an expression for the conserved gyrokinetic energy [2] to quantify the rate at which turbulent energy is transferred from linearly unstable to linearly damped modes; and to construct a nonlinear growth rate, measuring the rate at which energy is transferred between the turbulence and the background plasma. At finite amplitude it can differ significantly from the linear growth rate of the fastest growing mode, indicating the excitation of damped eigenmodes.

[1] P. W. Terry, D. A. Baver, and S. Gupta, Phys. Plasmas 13, 022307 2006
[2] Howes, G. G., Cowley, S. C., Dorland, W., Hammett, G. W., Quataert, E., & Schekochihin, A. A. 2006, ApJ, 651, 590